electrode **38**; t is thickness between connecting portions **36** facing that of the sensing electrode **38**; and h_s is gap distance between the sensing electrode **38** and the connecting portions **36**. Since a voltage signal proportional to the change of the capacitance can be detected by using a general circuit for detecting the change of the capacitance, an angular velocity signal can be consequently detected.

In the meantime, as a common factor for determining performance of a microgyroscope, congruity of the natural frequencies in the X- and Y-axes is necessary to maximize displacement in the Y-axis by Coriolis force. In the present invention, since stiffness of the vibratory structure **50** in the Y-axis direction is affected by an electrostatic force generated by the sensing electrode **38**, the natural frequency can be adjusted using such a electrostatic force. The natural frequency (f_n) in the Y-axis direction can be expressed by the following equation.

$$f_n = \frac{1}{2\pi}\sqrt{\frac{k_b - k_n}{m}}$$

Here, k_b is a spring constant of the springs **32** and **32'**, and k_n is a spring constant generated by the electrostatic force between the sensing electrode **38** and the connecting portions **36**. k_n can be expressed by the following equation.

$$k_n = V_b^2\left(\frac{2\epsilon l_s t n_s}{h_s^3}\right)$$

In the above equation, ϵ is the dielectric constant of air; l_s is the length of the sensing electrode **38**; h_s is the gap distance between the sensing electrode **38** and the connecting portions **36**; V_b is a bias voltage applied to sensing electrode **38**. The congruity of the natural frequencies in the X-axis direction and of the Y-axis direction can be achieved by adjusting the bias voltage. However, since the change of an output is caused in the microgyroscope when the bias voltage of the sensing electrode **38** varies in such an adjusting fashion, a more accurate adjustment can be performed using another method of fixing the bias voltage of the sensing electrode **38** and installing an additional electrode for adjusting the natural frequency. The electrode for adjusting the natural frequency (not shown) is arranged in parallel with the connection portions **36** of vibratory structure **50** in a form similar to sensing electrode **38**.

As described above, the microgyroscope according to the present invention adopting a new vibratory structure and the sensing electrode has merits of solving problems in machining the vibratory structure and simultaneously improves performance thereof. Also, contrary to the conventional technology where adjustment of the natural frequency of the vibratory structure in two directions is difficult, each factor for determining the natural frequency is determined in a single process and the performance becomes stable. In particular, the work of squaring the natural frequencies with each other renders efficient since the work can be performed by applying the bias voltage to the sensing electrode instead physically machining the vibratory structure. Further, since the position control can be efficiently performed by the position control electrode, linearity and resolution can be enhanced and measurement range thereof are enhanced.

What is claimed is:

1. A microgyroscope comprising:

a substrate;

a vibratory structure having first and second stripe portions disposed in parallel with each other in which first and second combs are formed at one side of said first and second stripe portions respectively, and a plurality of connecting portions for connecting said first and second stripe portions;

elastic means for elastically supporting said vibratory structure to be spaced from said substrate at a predetermined gap;

driving means, having a third comb interposed between said first comb of said first stripe portion, for applying said vibratory structure in one direction due to an electrostatic force;

sensing means, having a fourth comb interposed between said second comb of said second stripe portion, for sensing the movement of said vibratory structure driven by said driving means through a change of capacitance; and

a plurality of sensing electrodes, disposed between said connecting portions of said vibratory structure on the same plane as that of said vibratory structure to be spaced from said substrate at a predetermined gap, for sensing displacement of said vibratory structure due to Coriolis force through a change of capacitance.

2. A microgyroscope according to claim **1**, further comprising position control electrodes arranged on the same plane as that of said vibratory structure, spaced from said substrate at a predetermined gap, in parallel with said connection portions of said vibratory structure in order to restrain an excess displacement of said vibratory structure due to Coriolis force.

3. A microgyroscope according to claim **1**, further comprising an excess action prevention member for preventing said vibratory structure excessively deformed by Coriolis force from contacting said sensing electrodes.

4. A microgyroscope according to claim **1**, wherein first portions of said elastic means are extended in a direction perpendicular to said first and second stripe portions, second portions of said elastic means connecting ends of said first portion of said elastic means to each other, and further comprising supports formed at the middle of said second portions of said elastic means so that said vibratory structure is elastically maintained spaced from said substrate at said predetermined gap.

5. A microgyroscope according to claim **1**, wherein three portions of said sensing electrodes are arranged in two parallel rows between said connection portions of said vibratory structure, wherein a longer portion among said three portions includes a support in a middle portion thereof and two shorter portions among said three portions each include a support at one end thereof, said three portions being axially aligned.

6. A microgyroscope according to claim **1**, wherein the natural frequency of said vibratory structure can be adjusted by changing voltage applied to said sensing electrodes.

7. A microgyroscope according to claim **1**, further comprising an electrode disposed in parallel with said connecting portions of said vibratory structure, for adjusting the natural frequency of said vibratory structure.

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